

DR. H. CLIFTON SORBY, F.R.S., Etc.


WITH

List of Papers and Monographs.

(Reprinted from 'The Naturalist,' May, June, July, 1906.)

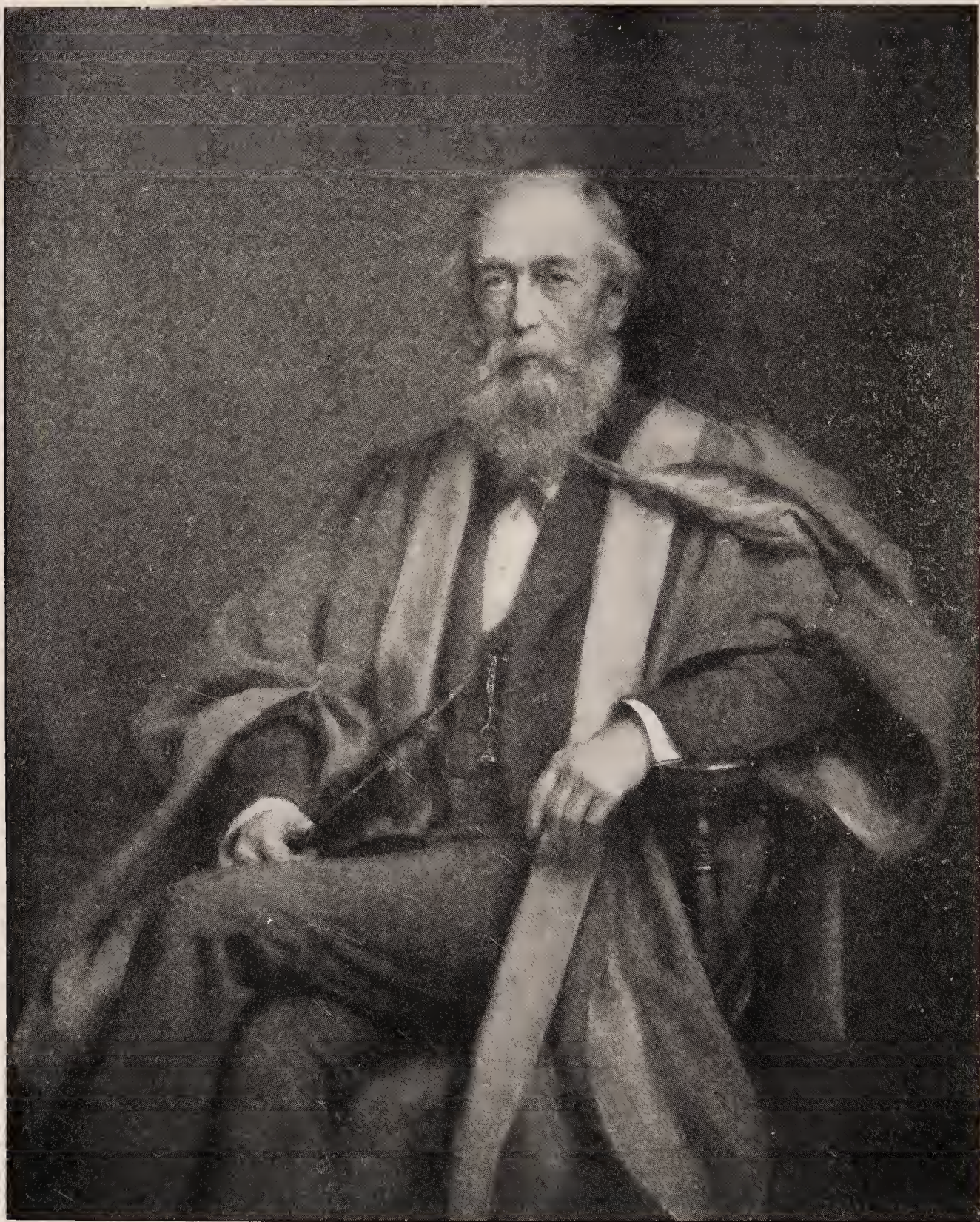
A. BROWN & SONS, Ltd., London, Hull, & York.

1906.



Digitized by the Internet Archive
in 2019 with funding from
Wellcome Library

<https://archive.org/details/b30608776>



H. C. Lorby April 5th/6

PROMINENT YORKSHIRE WORKERS.

I.—HENRY CLIFTON SORBY, LL.D., F.R.S., F.S.A., F.G.S., etc.

(PLATE XIII.)

It is proposed to give occasionally in these pages a brief account of the life of some of our leading Yorkshire workers. The selection of the first of the series has not been in the least difficult. In Dr. H. C. Sorby it can be safely said we have a scientific man, whose standing as such is of the highest possible. His reputation is world wide. During the past sixty years he has devoted some attention to almost every branch of natural and applied science, and everything he has touched has been the better for it. Probably no living man has accomplished so much in such a variety of ways as has the subject of our sketch, and few can boast of having occupied more official positions in so many scientific societies than has he. Besides all this, Yorkshiremen will for ever respect his name for the keen interest he has always taken in the scientific welfare of Yorkshire, and particularly the city in which his life has been spent—Sheffield. In the affairs of the Yorkshire Naturalists' Union he has at all times taken the keenest interest—has helped its work in every way in his power, and the Union conferred upon him the greatest honour in its power by asking him to be the first to occupy the Presidential chair.

Dr. Sorby has been fortunate in being able to devote his whole life to scientific research—an opportunity which is open to many but rarely taken advantage of. To a prize he obtained at school, entitled 'Readings in Science,' he partly attributes the desire he subsequently had for investigation. Later he had for a tutor one who was well informed in mathematics, chemistry, and anatomy, whose influence also left its impression upon the scholar. In addition to the subjects named, Dr. Sorby devoted some attention to optics and water-colour drawing, and all these he found of the greatest possible value to him in his subsequent career.

In 1897 he delivered an address to the Sheffield Literary and Philosophical Society, entitled 'Forty Years of Scientific Research,'* in which he points out that he worked in his young days '*not to pass an examination*' but to qualify himself for a career of original investigation. That such a course

* I am indebted to this for much of the information here given.

was beneficial is well proved by what has subsequently taken place, and a perusal of the list of memoirs at the end of these notes is evidence of the benefit of his early method of work. And it must be borne in mind that these memoirs are by no means of the ordinary class of papers, as many of them certainly indicate distinct epochs in the advance of our knowledge of the subjects dealt with.

It may not be without interest to briefly refer to a few of the subjects that have occupied his attention. To even mention them all would be a very serious undertaking, such has been the untiring energy which Dr. Sorby has shown all through his life. It can be safely said that he has never been idle, and when the writer had the pleasure of spending some hours with him only a few days ago, he was much impressed with the Doctor's energy—certainly far exceeding that of many men half-a-century his junior. And although he is in his eightieth year, and unable to walk, through an unfortunate series of accidents, he still spends many more hours a day at his work than do most 'business'-men, and he has as many 'irons in the fire' as ever.

His first papers dealt with animal and vegetable chemistry, and were published so long ago as 1847. About the same time, sheltering from a shower of rain in a quarry near Handsworth, his attention was attracted to what he afterwards called 'current structure,' viz., structures produced in stratified rocks by the action of currents present during their deposition. Since then many more papers on the subject have appeared from his pen, some of them being of a most important character.

It is in connection with his work with the microscope that Dr. Sorby is best known. His first piece of microscopical work had reference to the small shells of the so-called 'Bridlington Crag.' About the same time he made the acquaintance of the late Prof. Williamson, then practising as a surgeon in Manchester. Williamson showed him his collection of sections of fossil wood, teeth, bones, etc., and explained how they were made. In these Dr. Sorby found new fields for work, and in 1849 it occurred to him that much might be done by applying a similar method to the structure of rocks. He was the first to prepare transparent microscopic sections of rocks. Not unnaturally his earlier efforts were laughed at—had not Saussure stated that mountains must not be examined with microscopes? Our present knowledge of the structure of rocks, however, is largely due to the fact that Sorby studied on heedless of his critics.

In the following year, 1850, the first of a lengthy series of papers on the microscopic structure of rocks appeared, and dealt with the Calcareous Grit at Scarborough, and even at that period practically all the methods of examining rock sections known to-day had been developed by Dr. Sorby.

A year later some papers in the *Quarterly Journal of the Geological Society*, dealing with slaty cleavage, directed his attention to that subject. Up to that time various theories had been advanced to account for this structure, and at the Museum of Practical Geology an experiment was made which 'proved' that cleavage was 'due to the action of weak electric currents passing through deposits!' The late Sir Henry de la Beche told Sorby that the question had been thoroughly settled at the Museum. Still working on his own lines, however, Sorby eventually demonstrated that 'slaty cleavage was due to mechanical pressure, acting in a peculiar way and developing its characteristic structure in a plane perpendicular to it.' His paper on the subject was sent to the Geological Society, but the then President (Wm. Hopkins) had a theory of his own that cleavage was developed at an angle of 45 degrees to the pressure! A lengthy correspondence followed, and eventually the paper was withdrawn and published elsewhere. Since that time Dr. Sorby has heard nothing of either Mr. Hopkins' or the electric theory of slaty cleavage! Work amongst the schistose crystalline rocks was next taken up with good results.

His examinations of thin sections of limestone rocks showed that a knowledge of the microscopic structure of shells, corals, and other marine calcareous organisms was necessary before the rock sections could be properly understood. In this connection it soon became evident that the question as to whether the shells were of calcite or aragonite was a matter of paramount importance. This subject has since been followed up by Prof. P. F. Kendall.*

The microscopic structure of minerals then occupied his attention, his work thereon being such that on the formation of the Mineralogical Society of Great Britain and Ireland he was elected the first President. Sorby was the first to point out the existence in certain igneous rocks of what he called 'glass cavities,' analogous to 'fluid cavities,' only that when the crystalline minerals were formed they caught up a liquid which on cooling solidified into glass. It was thus proved that the

* "Calcareous Organisms," *Geol. Mag.*, Feb. 1888.

minerals in these rocks crystallised out from a solvent in the state of glassy fusion. 'This fact at once settled the question so long disputed between the Wernerians and Huttonians.' These inclusions in minerals indicated whether the rocks had been formed by the action of water or of fusion or by the two combined under pressure.

In 1858 he read a paper to the Geological Society on 'The Microscopical Structure of Crystals, indicating the origin of minerals and rocks.' The late Leonard Horner, the only surviving original Fellow, was in the chair, and after the paper was read stated that he had been a member of the Society ever since its foundation, but 'did not remember any paper having been read which drew so largely on their credulity,' the facts being so new and remarkable! Sorby was also the first to point out that certain minerals contained liquid carbonic acid, and described its striking properties.

The microscopical character of loose sand-grains then occupied his thought, and they were found to possess features having an important bearing upon the origin of certain sandstone rocks. Next followed his explanation of the so-called 'crystalline sands,' which contain crystals of quartz due to the deposition of crystalline quartz around ordinary grains of sand which had acted as nuclei. A study of pseudomorphs—crystals in the form of one mineral, but with the chemical composition of another—resulted in many important discoveries. About 1860 he made a whole series of artificial pseudomorphs by the action of cold or highly-heated solutions. It was demonstrated that certain rocks, such as the Cleveland ironstone, 'were originally composed of carbonate of lime, but have been altered to carbonate of iron, the carbonate of lime having been dissolved, and carbonate of iron derived from the associated strata deposited in its place.'*

Following on this line of research upon the structure of rocks, he eventually proved that there is a direct correlation between mechanical pressure and certain kinds of chemical action, and gave the results of his work in a paper to the Royal Society, which formed the Bakerian Lecture for 1863.

Experiments on the freezing point of water and on the expansion of water and saline solutions at high temperatures

* In connection with the Guisborough meeting of the Yorkshire Naturalists' Union, to be held in August next, the question of the origin of the Cleveland Ironstone is to be discussed. Dr. Sorby has kindly agreed to contribute a paper on the subject on that occasion.

followed, by the aid of which it was possible to calculate the approximate temperature at which certain minerals had been formed in Nature.

From the foregoing notes it will be seen how deeply indebted present-day geologists are to Sorby's pioneer work in regard to the microscopic structure of rocks. In fact, a study of Dr. Sorby's work is almost an epitome of the history of geological science in recent years.* So long ago as 1872 the Dutch Society of Science awarded him the first large gold Boerhaave medal for having done more than anyone else to advance the sciences of geology and mineralogy during the preceding twenty years.

From the study of the structure of rocks followed that of meteorites, and in order to properly consider the latter an investigation of artificial iron was started. This was in 1863, and in the following year a paper was read to the British Association on the subject, the full economical value of which remained unrecognised for over twenty years. In 1887, however, the Iron and Steel Institute appointed Dr. Percy, Sir Henry Bessemer, and Dr. Sorby to decide upon the best method of illustrating a complete paper on the subject. Since then the importance of a microscopical investigation of iron and steel has been generally recognised. 'In those early days,' writes Dr. Sorby, 'if a railway accident had occurred, and I had suggested that the company should take up a rail and have it examined with the microscope, I should have been looked upon as a fit man to send to an asylum. But that is what is now being done.' What Dr. Sorby proved was that various kinds of iron and steel consist of varying mixtures of well-defined substances, and that their structure is in many respects similar to that of igneous rocks.

Following this much work was accomplished in connection with blow-pipe chemistry, and he showed that much could be learned by studying the microscopical character of the crystals deposited in blow-pipe beads allowed to cool very slowly over a lamp.

Continual work with the microscope, particularly relating to the study of meteorites, led to several improvements being made in connection with the instruments. He invented the spectrum microscope, with a new arrangement to get what is

* In the 'list of authorities' in Geikie's 'Text-book of Geology' Dr. Sorby is responsible for more references than is any other author. He is also one of those included in Geikie's 'Founders of Geology.'

called 'direct vision.' Then followed lengthy researches upon various branches of enquiry in which colour plays a part—about forty papers being written on these subjects. In these the colouring matters of human hair and of birds' feathers, the pigments in birds' eggs, and the numerous colouring matters met with in almost every group of plants, were dealt with. From these it was an easy step to the detection of blood stains, work which has since proved exceedingly useful in connection with criminal investigation. The microscopical examination of sewage also followed, and, like most of Dr. Sorby's work, with most useful results from an economical point of view.

From 1879, and until his accident a few years ago, Dr. Sorby lived about five months of each year in his yacht the 'Glimpse.' This naturally necessitated a change in his work. On board the 'Glimpse' investigations were carried on in connection with the seas and estuaries, and their animal and plant and inorganic contents. The results of some of these investigations have appeared and are appearing in the Victoria County Histories (Essex, Kent, and Suffolk). In addition to paying attention to meteorology, the colour of the sea and sky, and taking observations extending over several years on the temperature of seas and estuaries and the amount of salt present in the water, he collected and preserved various marine objects. The colouring matters of these were studied, and extensive experiments made as to the best methods of preserving both the organisms and their colours. Details of these have already been contributed to this Journal by Dr. Sorby.* More recently, attempts to shew both marine animals and plants as transparent lantern slides have met with great success.

In the Thames, Dr. Sorby has spent much time studying the changes which take place in connection with the sand-banks in the estuary and other changes which take place. In connection with the Royal Commission on the drainage, he in 1882 occupied seven hours a day for 240 days in studying the Thames.

Thus in matters geological, physiographical, biographical, physiological, botanical, and hydrographical has Dr. Sorby worked, and worked well. But these are by no means the only subjects which have occupied his attention. His researches relating to the changes in the vicinity of the Isle of Thanet necessitated his acquaintance with archæological matters. He

* 'On the Preservation of Marine Animals.' 'Naturalist,' Nov., 1903, pp. 437-440.

examined Roman, Saxon, and Norman buildings, and this led to a detailed study of the structure of building materials and experiments thereon. The dimensions of bricks used in the buildings of various periods were also carefully worked out.

Whilst at work on Norman and Saxon architecture he examined various early illustrated manuscripts in the British Museum and elsewhere. These showed a varying length of unit used by the scribes in making manuscripts, a knowledge of which Sorby has shown to be of value in ascertaining where the manuscripts were prepared. 'Some of the early Irish scribes seem to have used the old Greek foot. Other manuscripts are on the scale of our present English foot, which was used extensively in Saxon times. Very early manuscripts, probably made in Italy, are written to the scale of the old Roman foot; whereas certain Continental manuscripts are written on the scale of the much larger old French foot.'

This archæological work led Dr. Sorby to study early cosmogony and geography, and also the archæology of natural history, in order to explain the origin of ideas with regard to a great number of the more or less mythological animals met with in early art. To carry out this thoroughly, a knowledge of the early Egyptian hieroglyphic language was necessary, and in his characteristically thorough manner, this was mastered. He has gathered together a vast collection of most of the original works of importance bearing on the subject, from the earliest period down to mediæval times, and he hopes that their study will lead to important conclusions in connection with the history of science and art.

Such is a brief summary of the principal lines of investigation which have occupied the attention of Dr. Sorby, who is yet as hard at work as ever. In addition to the work for the Victoria County Histories, and the other items referred to, he is at present busy applying quantitative methods to the study of the structure of almost every geological formation, a work which, when completed, will unquestionably hold a foremost position amongst the many fine achievements that stand to his credit.

It is only natural that one who has done so much for science should be recognised by the scientific world. Honours have deservedly been showered upon him from all parts. He was elected a Fellow of the Geological Society in 1853, a Fellow of the Royal Society in 1857, a corresponding member of the Academy of Natural Sciences of Philadelphia, and of the Lyceum of Natural History of New York in 1858, a member

of the Imperial Mineralogical Society of St. Petersburg in 1862, an honorary member of the Manchester Literary and Philosophical Society in 1869, and a Foreign member of the Royal Dutch Society of Science in 1872, and he is a member of the Academy of Lynxes of Rome, Foreign member of the Microscopical Society of Brussels, and of the American Academy of Arts and Sciences, honorary member of the Natural History Society of Torquay, a Fellow of the Society of Antiquaries, and of the Zoological and of the Linnean Societies. In 1879 the degree of LL.D. was conferred upon him by the University of Cambridge.

The Geological Society awarded to him the Wollaston Medal in 1869; in 1872 he received the first large gold Boerhaave medal issued by the Dutch Society of Science; and in 1874 he received a Royal medal from the Royal Society of London.

He has been through the Presidential Chair of several important societies. In 1878-80 he was president of the Geological Society of London. He was the first president of the Mineralogical Society, and president of the Microscopical Society of Great Britain and Ireland in 1875-1878, and of the Geological Section of the British Association in 1880. He was the first to occupy the presidential chair of the Yorkshire Naturalists' Union, as at present constituted. In 1852, 1870-1-2, 1879, 1894, 1897, and 1898 he was elected president of the Literary and Philosophical Society in his native city, Sheffield, a city which has greatly benefitted by his presence therein. A few years ago the Sheffield Literary and Philosophical Society presented him with a handsome portrait of himself, in commemoration of his fifty years connection with the Society. This was painted by Mrs. M. L. Waller, and by the kindness of the publishers of this journal, we are able to give each of our readers an excellent though small copy of this (plate XIII.). In February last a replica of the portrait painted by Mrs. Waller was presented to the Sheffield University, of which Dr. Sorby is one of the founders and has taken such a practical interest in since its foundation. We can only hope that Dr. Sorby may long be spared to continue his useful work.—T.S.

LIST OF PAPERS AND MONOGRAPHS

By Dr. H. CLIFTON SORBY, F.R.S.. &c.

(Continued from page 144.)

On the Amount of Sulphur and Phosphorus in various Agricultural Crops. Chem. Soc. Mem., III., 1845-48, pp. 281-284; Forriep's Notizen, IV., 1847, col. 35-37; Phil. Mag., XXX., 1847, pp. 330-334.

On the Formation of the Valleys; and on the Modern and Ancient River Action in the Neighbourhood of Sheffield. Sheffield Lit. and Phil. Soc. Rep., 1847, Aug. 6th and Dec. 3rd; 1848, March 3rd.

On the Geology of the Malvern Hills. Sheffield Lit. and Phil. Soc. Rep., 1849, p. 15.

On the Probable Former Existence of a Tract of Land between Norway and Scotland, as indicated by the Fossils and Structure of the Oolitic Rocks of the Yorkshire Coast. Sheffield Lit. and Phil. Soc. Rep., 1850, p. 7.

Observations on the Northern Drift or Diluvium, together with a General Outline of the Present State of the Theories of the Origin of these and Similar Deposits. Sheffield Lit. and Phil. Soc. Rep., 1850, p. 13.

On the Tetramorphism of Carbon. Brit. Assoc. Rep., 1850 (pt. 2), p. 62.

On the Existence of Four Crystalline Species of Carbon. Proceed. West Yorks. Geol. Society, III., 1850, pp. 159-168.

On the Excavation of the Valleys in the Tabular Hills, as shown by the Configuration of Yedmandale, near Scarborough. Proceed. West Yorks. Geol. Soc., III., 1850, pp. 169-172.

On the Tetramorphism of Carbon. Edinb. New Phil. Journ., L., 1851, pp. 149-159.

On the Microscopical Structure of the Calcareous Grit of the Yorkshire Coast. Geol. Soc. Journ., VII., 1851, pp. 1-6; Proceed. West. Yorks. Geol. Soc., III., 1851, pp. 197-206.

On the Contorted Stratification of the Drift of the Coast of Yorkshire. Proceed. West Yorks. Geol. Soc., III., 1851, pp. 220-224.

On the Oscillation of the Currents Drifting the Sandstone Beds of the South-East of Northumberland, and on their General Direction in the Coalfield in the Neighbourhood of Edinburgh. Proceed. West. Yorks. Geol. Soc., III., 1851, pp. 232 et seq.

On the Occurrence of Non-gymnospermous Wood in the Lias, near Bristol. Microsc. Soc. Trans., III., 1852, pp. 91, 92.

On the Oscillation of the Currents drifting the Sandstone Beds of the South-East of Northumberland, and on their General Direction in the Coalfield in the Neighbourhood of Edinburgh. Proceed. West. Yorks. Geol. Soc., III., 1852, pp. 232-240.

On the Existence of an Analogy between the Symmetrical Development of Organised Beings and Crystallized Bodies. Sheffield Lit. and Phil. Soc. Rep., 1852, p. 7.

On the Microscopical Structure of some British Tertiary and Post-tertiary Fresh-water Marls and Limestones. Geol. Soc. Journ., IX., 1853, pp. 344-346.

On the Origin of Slaty-cleavage. Edinb. New Phil. Journ., LV., 1853, pp. 137-150.

On the Origin of Slaty-cleavage. Proceed. West. Yorks. Geol. Soc., III., 1853, pp. 300-311.

On the Microscopical Structure of British Calcareous Rocks, including those of the Recent, Post Tertiary, Tertiary, and Cretaceous Periods. Sheffield Lit. and Phil. Soc. Rep., 1853, p. 9.

Observations made during a Three Months' Geological Tour in the South-West of England. Sheffield Lit. and Phil. Soc. Rep., 1853, p. 13.

On Yedmandale, as Illustrating the Excavation of some Valleys in the Eastern part of Yorkshire. Geol. Soc. Journ. X., 1854, pp. 328-333.

On the Motions of Waves as Illustrating the Structure and Formation of Stratified Rocks. Proceed. West. Yorks. Geol. Soc., VII., 1854, pp. 372 et seq.

On Determining by Mathematical Calculation the Form of the Ultimate Atoms of Crystalline Substances from a Comparison of their Specific Gravities and other Properties. Sheffield Lit. and Phil. Soc. Rep., 1854, p. 5.

On Changes of Climate, particularly with reference to that of the Glacial Period. Sheffield Lit. and Phil. Soc. Rep., 1854, p. 11.

On the Direction of Drifting of the Sandstone Beds of the Oolitic Rocks of the Yorkshire Coast. Proceed. Yorks. Phil. Soc., Vol. I., 1855, pp. 111-113.

On the Motion of Waves, as Illustrating the Structure and Formation of Stratified Rocks. Proceed. West Yorks. Geol. Soc., III., 1855, pp. 372-378.

On the Structure and Mutual Relationships of the Older Rocks of the Highland Border. Brit. Assoc. Rep., 1855 (pt. 2), pp. 96, 97.

On Some of the Mechanical Structures of Limestones. Brit. Assoc. Rep., 1855, (pt. 2), p. 97.

On the Currents produced by the Action of Winds and Tides, and the Structures Generated in the Deposits formed under their Influence, by which the Physical Geography of the Seas at Various Geological Epochs may be ascertained. Brit. Assoc. Rep., 1855 (pt. 2), pp. 97, 98.

On a Partially-constructed Ancient Camp in Great Roe Wood, near Sheffield. Sheffield Lit. and Phil. Soc. Rep., 1855, p. 6.

Researches into the Physical Geology of Kent, Sussex, Hampshire, and the Isle of Wight. Sheffield Lit. and Phil. Soc. Rep., 1855, p. 8.

On the Origin of the Cleveland Hill Ironstone. Proceed. West. Yorks. Geol. Soc., III., 1856, pp. 457-461.

On the Physical Geography of the Old Red Sandstone Sea in the Central District of Scotland. Edinb. New Phil. Journ., III., 1856, pp. 112-122.

On Slaty-cleavage, as Exhibited in the Devonian Limestones of Devonshire. Phil. Mag., XI., 1856, pp. 20-37.

On the Theory of the Origin of Slaty-cleavage. Phil. Mag., XII., 1856, pp. 127-129.

Description of a Working Model to Illustrate the Formation of 'Drift Bedding' (a kind of False Stratification). Brit. Assoc. Rep., 1856 (pt. 2), p. 77.

On the Terraces in the Valley of the Tay, North of Dunkeld. Edinb. New Phil. Journ., IV., 1856, pp. 317-321.

On the Structure and Mutual Relationships of the Older Rocks of the Scottish Highland Border. Sheffield Lit. and Phil. Soc. Rep., 1856, p. 10.

On the Microscopical Structure of Mica-schist. Brit. Assoc. Rep., 1856 (pt. 2), p. 78; Edinb. New Phil. Journ. (2 ser.), IV., p. 339; Neues Jahrbuch für Mineralogie, 1857, p. 89.

On the Magnesian Limestone having been Formed by the Alteration of an Ordinary Calcareous Deposit. Brit. Assoc. Rep., 1856 (pt. 2), p. 77; Edinb. New Phil. Journ. (2 ser.), IV., pp. 338, 339; Neues Jahrbuch für Mineralogie, 1857, p. 89.

On the Physical Geography of the Tertiary Estuary of the Isle of Wight. Edinb. New Phil. Journ., V., 1857, pp. 275-298.

On the Crag Deposit at Bridlington, and on the Microscopical Fossils occurring in it. *Proceed. West. Yorks. Geol. Soc.*, III., 1857, pp. 559-562.

On some Facts Connected with Slaty-cleavage. *Brit. Assoc. Rep.* 1857 pt. 2), pp. 92, 93.

On the Magnesian Limestone having been formed by the Alteration of an Ordinary Calcareous Deposit. *Sheffield Lit. and Phil. Soc. Rep.*, 1857, p. 6.

Sur le Mode de Consolidation du Granite et de Plusieurs autres Roches. *Paris, Comptes Rendus*, XLVI., 1858, pp. 146-149.

On the Ancient Physical Geography of the South-East of England. *Edinb. New Phil. Journ.*, VII., 1858, pp. 226-237.

On the Currents Present during the Deposition of the Carboniferous and Permian Strata in South Yorkshire and North Derbyshire. *Brit. Assoc. Rep.*, 1858 (pt. 2), p. 108.

On the Microscopical Structure of Crystals Indicating the Origin of Minerals and Rocks. *Geol. Soc. Journ.*, XIV., 1858, pp. 453-500.

On the Current-structures of Rocks and their Application to the Study of the Physical Geography of Ancient Geological Periods. *Sheffield Lit. and Phil. Soc. Rep.*, 1858, p. 9.

On some Peculiarities in the Microscopical Structure of Crystals, Applicable to the Determination of the Aqueous and Igneous Origin of Minerals and Rocks. *Edinb. New Phil. Journ.*, VII., 1858, pp. 371-373; *Neues Jahrbuch für Mineralogie*, 1860, pp. 86, 87.

On a New Method of Determining the Temperature and Pressure at which Various Rocks and Minerals were formed. *Brit. Assoc. Rep.*, 1858 (pt. 2), p. 107; *Edinb. New Phil. Journ.*, IX., 1859, p. 151; *Neues Jahrbuch für Mineralogie*, 1860, p. 85.

On some Peculiarities in the Arrangement of the Minerals in Igneous Rocks. *Brit. Assoc. Rep.*, 1858 (pt. 2), pp. 107-108; *Edinb. New Phil. Journ.*, IX., 1859, p. 150; *Neues Jahrbuch für Mineralogie*, 1860, p. 85.

On the Structure and Origin of the Millstone-grit of South Yorkshire. *Proceed. West Yorks. Geol. Soc.*, III., 1859, pp. 669-675.

On the Expansion of Water and Saline Solutions at High Temperatures. *Phil. Mag.*, XVIII., 1859, pp. 81-91.

On the Freezing Point of Water in Capillary Tubes. *Phil. Mag.*, XVIII., 1859, pp. 105-108; *Annal. de Chemie*, LVIII., 1860, pp. 253, 254; *Journ. de Pharm.*, XXXVII., 1860, pp. 124, 125; *Archiv. de Sc. Phys.* (2), VI., p. 294; *Zeitsch. für Naturw.*, XIV., p. 43; *Il Nuovo Cimento*, X., pp. 386, 387.

On the Structures Produced by the Currents present during the Deposition of Stratified Rocks. *Geologist*, II., 1859, pp. 137-147.

On the Origin of 'Cone in Cone.' *Brit. Assoc. Rep.*, 1859 (pt. 2), p. 124; *Geologist*, II., 1859, p. 485.

On the Temperature of the Springs in the Neighbourhood of Sheffield. *Proceed. West. Yorks. Geol. Soc.*, IV., 1859, pp. 40-45.

On the Formation and Structure of Granitic Rocks. *Sheffield Lit. and Phil. Soc. Rep.*, 1859, p. 11.

De l'Action prolongée de la Chaleur et de l'Eau sur Différentes Substances. *Bull. Paris, Comptes Rendus*, L., 1860, pp. 990-992.; *Soc. Geol. de France*, XVII., 1860, pp. 568-571; *Neues Jahrbuch für Mineralogie*, 1861, pp. 697, 698; *Jahresbericht über die Fortschritte der Chemie*, 1860, pp. 61, 62; *Chemical News*, II., 1860, p. 270.

Sur l'application du microscope à l'étude de la géologie physique. *Bull. Soc. Geol. de France*, XVII., 1860, pp. 571-573; *Neues Jahrbuch für Mineralogie*, 1861, pp. 769-771; *Madrid, Revista*, XI., 1861, pp. 449-451.

On the Organic Origin of the so-called "crystalloids" of the Chalk. *Annal. Nat. Hist.*, VIII., 1861, pp. 193-200.

On M. Boucher de Perthes' Collection of Flint Implements from the Drift of Abbeville and on the Recent Discovery of Similar Objects in the Neighbourhood of Paris. *Sheffield Lit. and Phil. Soc. Rep.*, 1861, p. 12.

On the Cause of the Difference in the State of Preservation of different kinds of Fossil Shells. *Brit. Assoc. Rep.*, 1862 (pt. 2), pp. 95, 96; *Geol. V.*, 1862, p. 423.

On the Comparative Structure of Artificial and Natural Igneous Rocks. *Brit. Assoc. Rep.*, 1862 (pt. 2), p. 96.

On Crushed and Impressed Pebbles. *Sheffield Lit. and Phil. Soc. Rep.*, 1862, p. 16.

On the Direct Correlation of Mechanical and Chemical Forces (Bakerian Lecture). *Royal Soc. Proceed.*, XII., 1863, pp. 538-550; *Phil. Mag.* (4 ser.), XXVII., pp. 145-154; *Il Nuovo Cimento*. XVII., 1863, pp. 272-275; *Jahresbericht über die Fortschritte der Chemie*, 1863, pp. 94-97; *Chem. C. Bl.*, 1864, pp. 321-324; *Archiv. Sc. Phys.* (pt. 2), XX., pp. 43-45.

On the Original Nature and Subsequent Alteration of Mica-schist. *Geol. Soc. Journ.*, XIX., 1863, pp. 401-406.

On the Microscopical Structure of Mount Sorrel (Grooby) Syenite Artificially Fused and Slowly Cooled. *Proceed. West Yorks. Geol. Soc.*, IV., 1863, pp. 301, 304.

On Models illustrating Contortions in Mica-schist. *Brit. Asso. Rep.*, 1863, (pt. 2), p. 88.

Ueber Kalkstein-Geschiebe mit Eindrücken. *Neues Jahrbuch für Mineralogie*, 1863, pp. 801-807; *Jahresbericht über die Fortschritte der Chemie*, 1863, pp. 854, 855.

An Account of a Geological Tour in the District of the Rhine. *Sheffield Lit. and Phil. Soc. Rep.*, 1863, p. 11.

On a New Method of illustrating the Structure of various kinds of "Blister" Steel by Nature Printing. *Sheffield Lit. and Phil. Soc.*, Feb. 1864.

On the conclusion to be Drawn from the Physical Structure of some Meteorites. *Brit. Assoc. Rep.*, 1864 (pt. 2), p. 70.

On the Microscopical Structure of Meteorites. *Royal Soc. Proceed.*, XIII., 1864, pp. 333, 334; *Phil. Mag.* (4 ser.), XXVIII., pp. 157-159; *Brit. Assoc. Rep.*, 1865 (pt. 1), pp. 139, 140; *L'Institut*, 1865, pp. 46, 47.

On Microscopical Photographs of various kinds of Iron and Steel. *Brit. Assoc. Rep.*, 1864 (pt. 2), p. 189; *Dingler's Polytec. Journ.*, CLXXVII., 1865, p. 468.

On the Application of Spectrum Analysis to Microscopical Investigations, and especially to the Detection of Blood-stains. *Quar. Journ. of Sci.*, II., 1865, pp. 198-215; *Chemical News*, XI., pp. 186, 194, 232, and 256; *Die Fortschritte der Physik*, Berlin, XXI., 1865, pp. 236, 237; *Les Mondes* (2 ser.), XIII., 279.

On a New Form of Spectrum Microscope. *Brit. Assoc. Rep.*, 1865, (pt. 2), pp. 11, 12.

On Impressed Limestone Pebbles, as illustrating a New Principle in Chemical Geology. *Proceed. West Yorks. Geol. Soc.*, IV., 1865, pp. 458-461.

On the Physical History of Meteorites. Printed Privately, July 1865; *Brit. Assoc. Rep.*, 1865 (pt. 1), pp. 140-142.

(Continued from page 197.)

On the Cause of the Difference in the State of Preservation of Different Kinds of Fossil Shells. Sheffield Lit. and Phil. Soc. Rep., 1865, p. 10.

On a New Method of Detecting Blood Stains and Ascertaining their Approximate Age. Sheffield Lit. and Phil. Soc. Rep., 1865, p. 11.

On the Construction and Use of the Spectrum Microscope. Popular Sci. Review. V., 1866, pp. 66-77.

On the Physical History of Meteorites in Connection with the Nebular Theory. Sheffield Lit. and Phil. Soc. Rep., 1866, p. 10.

On a Definite Method of Qualitative Analysis of Animal and Vegetable Colouring Matters by means of the Spectrum Microscope. Royal Soc. Proceed., XV., 1867, pp. 433-455; Phil. Mag. (4 ser.), XXXIV., 1867, pp. 144-166; Die Fortschritte der Physik, Berlin, XXIII., 1867, pp. 261-264.

On a New Method of Detecting Poisoning by Belladonna and other Allied Fruits. Sheffield Lit. and Phil. Soc. Rep., 1868, pp. 16, 17; Medical Press and Circular, Nov. 27, 1867, p. 494.

On the Colour of the Clouds and Sky. Phil. Mag. (4 ser.), XXXIV., 1867, pp. 356-359; Les Mondes (2 ser.), XVI., pp. 115-117.

Le Microspectroscope, sa Construction et son Usage. Revue Universelle, XXI., 1867, pp. 337-354.

On the Direct Vision Spectrum Microscope and its Application to Qualitative Analysis. Sheffield Lit. and Phil. Soc. Rep., 1867, p. 5.

On the Microscopical Examination of Rocks, Crystals, and Fossils. Dr. Lionel Beale's "How to Work with the Microscope," 4th edit., 1868, pp. 174-181.

On the Microscopical Structure of Iron and Steel. Dr. Lionel Beale's "How to Work with the Microscope," 4th edit., 1868, pp. 181-183.

On the Spectrum Microscope and its Applications. Dr. Lionel Beale's "How to Work with the Microscope," 4th edit., pp. 218-228.

On the Colour of the Clouds and Sky. Sheffield Lit. and Phil. Soc. Rep., 1868, p. 8.

On the Colouring Matters of Blue Decayed Wood. Quar. Jour. of Micro. Sci. (new ser.), IX., 1869, pp. 43, 44.

On the Dichroism of some Zircons. Chemical News, XIX., 1869, pp. 122, 123.

On New Applications of the Microscope to Blow-pipe Chemistry. Chemical News, XIX., 1869, p. 124.

On the Application of the Microscope to Mineralogy. Quar. Jour. of Micros. Sci. (new ser.), IX., 1869, pp. 182, 183.

On the Structure of Rubies, Sapphires, Diamonds, and other Precious Stones. Royal Soc. Proceed., XVII., 1869, pp. 291-302.

On the Microscopical Structure of some Precious Stones. Mon. Micro. Journ., I., 1869, pp. 220-224.

On Crystals Inclosed in Blow-pipe Beads. Mon. Micro. Journ., I., 1869, pp. 349-352; Chemical News, XX., 1869, pp. 18, 19.

On a Blow-pipe Reaction of Thallium. Chemical News, XIX., 1869, p. 309.

The Microscope in Mineralogy. "Scientific Opinion," Feb. 24th, 1869 pp. 307, 308.

On Jargonium, a New Elementary Substance associated with Zirconium. Royal Soc. Proceed., XVII., 1869, pp. 511-515; Chemical News, XX., 1869, pp. 7-9; Phil. Mag. (4 ser.), XXXIX., 1870, pp. 65-70.

On some Technical Applications of the Spectrum Microscope. Quart. Journ. of Micro. Sci. (new ser), IX., 1869, pp. 358-383; Chemical News, XX., 1869, pp. 279, 294, 304, and 314.

On the Excavation of Valleys in Derbyshire, as illustrated by the Cavern in Deep Dale, near Buxton. Geol. Mag., VI., 1869, p. 347.

On the Colouring Matters derived from the Decomposition of Minute Organisms. Mon. Micro. Journ., III., 1870, pp. 229-231.

On some remarkable Spectra of Compounds of Zirconia and the Oxides of Uranium. Royal Soc. Proceed., XVIII., 1870, pp. 197-207; Chemical News, XXI., 1870, pp. 73-76; Phil. Mag. (4 ser.), XXXIX., 1870, pp. 450-460.

On the Spectrum of the Flame of the Bessemer Fumes. Chemical News, XXI., 1870, pp. 79, 80.

On the Detection of Blood by means of the Spectrum Microscope. Guy's Hospital Rep. (3 ser.) XV., 1870, pp. 274-377.

On some Compounds derived from the Colouring Matter of the Blood. Quar. Jour. of Micro. Science, X., 1870, pp. 400-402.

On the Application of the Microscope to the Study of Rocks. Mon. Micro. Journ. IV., 1870, pp. 148, 149.

On the various Tints of Autumnal Foliage. Quar. Journ. of Sci. (new ser.), I., 1871, pp. 64-77.

On the Spectrum Analysis of Blood-stains. The Medical Press and Circular (new ser.), XI., May 31st, 1871, p. 457; Brit. Med. Journ. May 27th, 1871, pp. 560, 561.

On some Improvements in the Spectrum Method of Detecting Blood. Monthly Micro. Journ., VI., 1871, pp. 9-17.

On the Colour of Leaves at Different Seasons of the Year. Quart. Journ. of Micro. Science, XI., 1871, pp. 215-234.

On Blood Stains. The Medical Press and Circular, XII., July 26th, 1871, pp. 67-70; The Doctor, I., August 1st, 1871, pp. 150, 151.

On the Various Tints of Foliage. Nature, IV., August 31st, 1871, pp. 341-343.

On the Jargonium Fallacy. The Lancet, I., August 19th, 1871, pp. 256, 257.

On the Examination of Mixed Colouring Matters with the Spectrum Microscope. Monthly Micro. Journ., VI., 1871, pp. 124-134.

On the Action of Heat on Blood. The Academy, II., Oct. 1st, 1871, p. 458

On the Colouring Matter of some Aphides. Quar. Journ. of Micro. Sci., XI., 1871, pp. 352-360; The Academy, II., p. 481.

On some Facts connected with the Colouring Matter of Aphides. The Medical Press and Circular, XII., Oct. 18th, 1871, pp. 333, 334.

On the best form of Compound Prism for the Spectrum Microscope. Nature, IV., Oct. 26th, 1871, pp. 511, 512; Quar. Journ. of Micro. Sci., XII., p. 68.

On the Spectra of Blood and Cochineal. Nature, IV., Oct. 26th, 1871, p. 505, and correction in V., Nov. 2nd, 1871, p. 7.

Review of Pryer's Blood Crystals. The Academy, III., Jan. 1st, 1872, pp. 13, 14.

On the Colouring Matter found in Fungi. Nature, V., Feb. 15th, 1872, p. 298.

On Comparative Vegetable Chromatology. Proceed. Royal Soc. XXI., 1873, pp. 442-483; Quar. Journ. Sci., III., 1873, pp. 451-465.

- Review of a work on Chlorophyll Colouring Matters.** *Nature* VIII., 1873, July 10th, p. 202, and July 17th, p. 224.
- On Photo-chemical Analysis or the Employment of Light as a Reagent in the Study of Animal and Vegetable Colouring Matters.** *Sheffield Lit. and Phil. Soc. Rep.*, 1873, p. 15.
- On the Study of Natural History.** *Nature*, IX., Jan. 22nd, 1874, p. 228.
- On some recent Astronomical Speculations and their Relation to Geology.** *Nature*, IX., May 19th, 1874, p. 388.
- On the Temporary Fading of Leaves Exposed to the Sun.** *Nature*, X., June 25th, 1874, p. 149.
- On Impressed Limestone Pebbles, illustrating a new principle in Physical Geology.** *Rep. and Trans. Cardiff Nat. Soc.*, V., 1874, pp. 21-25.
- On Comparative Vegetable Chromatology, being the Study of the Evolution of Plants from a New Point of View.** *Sheffield Lit. and Phil. Soc. Rep.*, 1874, p. 12.
- On the Chromological Relation of *Spongilla fluviatilis*.** *Quar. Journ. Micro. Sci.*, XV., 1875, pp. 47-52.
- On the Colouring Matter of *Bonellia viridis*.** *Quar. Journ. Micro. Sci.*, XV., 1875, pp. 166-172.
- On the connection between Fluorescence and Absorption.** *Mon. Micro. Journ.*, XIII., 1875, pp. 161-164.
- On the Discovery of Diatomaceæ in the Ashes of Coal, by Count Castracane.** *Nature* XI., April 15th, 1875, p. 475.
- On New and Improved Microscope Spectrum Apparatus, and on its application to various branches of research.** *Mon. Micro. Journ.*, XIII., 1875., pp. 198-208.
- On the Colouring Matters of the Shells of Birds' Eggs.** *Proceed. Zool. Soc.*, May 5th, 1875, pp. 351-365; *Nature*, XII., May 13th, 1875, p. 38; *Naturforschen*, IX., 1876, pp. 13-15.
- On the Characteristic Colouring Matters of the Red Group of Algæ.** *Journ. Linn. Soc.*, XV., 1875, pp. 34-40; *Nature* XII., May 13th, 1875, p. 38.
- On the Remains of a Fossil Forest in the Coal Measures at Wadsley, near Sheffield.** *Quar. Journ. Geol. Soc.*, XXXI., 1875, pp. 458-460; *Rep. Sheffield Lit. and Phil. Soc.*, 1876, p. 25.
- On a New Method of Measuring the Position of the Bands in Spectra.** *Mon. Micro. Journ.*, XIV., 1875, pp. 269-273; *Nature*, XIII., Nov. 11th, 1875, p. 39.
- On Some Recent Astronomical Speculations in their Relation to Geology.** *Sheffield Lit. and Phil. Soc. Rep.*, 1875, p. 13.
- Outlines of Comparative Chromatology.** *Sheffield Lit. and Phil. Soc. Rep.*, 1875, p. 25.
- On the Evolution of Hæmoglobin.** *Quar. Journ. Micro. Sci.*, XVI., 1876, pp. 77-85; *Nature*, XIII., Feb. 17th, 1876, p. 306.
- On the Colouring Matters associated with Chlorophyll.** *Journ. Bot.*, V., 1876, pp. 16-18.
- On the Connection between the limit of the Power of the Microscope and the Size of the Ultimate Molecules (Presidential Address).** *Mon. Micro. Journ.*, XV., 1876, pp. 105-121 and 194, 195; *Quar. Journ. Micro. Sci.*, XVI., 1876, pp. 225-234; *Nature* XIII., 1876, Feb. 24th, p. 331, and March 16th, p. 384.
- On the Colour of Flowers Grown in the Dark.** *Nature*, XIII., 1876, April 13th, p. 465.
- On Microscopes.** *Handbook of the Special Loan Collection of Scientific Apparatus*, pp. 327-339 (Chapman & Hall, London, 1876).

On Unencumbered Research—a Personal Experience. Endowment of Research, pp. 149-175 (King & Co., London, 1876).

On Count Castracane's Photograph of Nobert's 19th Band Mon. Micro. Journ., XV., 1876, p. 1.

On the Microscopical Structure of Amber. Mon. Micro. Journ., Nov., XIII., 1876, pp. 225-231.

On the Critical Point in the Consolidation of Granitic Rocks. Miner. Mag., Nov., 1876. 5 pp.

On the Colour of the Eggs and Feathers of Birds. Sheffield Lit. and Phil. Soc. Rep., 1876, p. 19.

On a New Form of Small Pocket Spectroscope. Monthly Mic. Jour., 1876, XVI., pp. 64-66.

On the Marine Biology of the Coast of Kent. Victoria History of the Counties of England.—Kent. In type, but not yet published.

The Application of the Microscope to Geology, &c. Anniversary Address of the President. Mon. Micro. Journ., XVII., 1877; March, 1877, pp. 113-136.

On a New Method for Determining the Index of Refraction of Minerals Presidential Address. Miner. Mag., No. 6, Sept., 1877, 16 pp.

On a Simple Method of Determining the Index of Refraction of Small Portions of Transparent Minerals. Miner. Mag., No. 4, 1877, 1 p.

On a New Arrangement for Distinguishing the Axes of Doubly Refracting Substances. Journ. Royal Micro. Soc., XVIII., 1877, pp. 209-211.

On some hitherto Undescribed Optical Properties of Doubly Refracting Crystals (Preliminary Notice). Proceed. Royal Soc., No. 183, 1877, 2 pp.

On the Limit of the Power of the Microscope, compared with the Size of the ultimate Molecules of Organic and Inorganic Matter. Sheffield Lit. and Phil. Soc. Rep., 1877, p. 13.

On the Determination of the Index of Refraction of Liquids by means of the Microscope. Journ. Chem. Soc., Nov., 1878, 8 pp.

On the Colouring Matters found in Human Hair. Journ. Anthropol. Inst., Aug., 1878, pp. 1-14.

On the Determination of the Minerals in Thin Sections of Rock by means of their Indices of Refraction. Miner. Mag., No. 8, April, 1878, 4 pp.

On a New Method of Studying the Optical Characters of Minerals. Proceed. Yorks. Geol. Polytec. Soc., 1878, pp. 1-11.

Further Improvements in Studying the Optical Characters of Minerals. Miner. Mag., X., Sept., 1878, 3 pp.

On a New Method for Studying the Chief Optical Properties of Minerals. Sheffield Lit. and Phil. Soc. Rep., 1878, p. 22.

On the Cause of the Production of different Secondary Forms of Crystals Miner. Mag., No. 14, 1879, 3 pp.

On the Structure and Origin of Limestone. Address delivered at the Anniversary Meeting of the Geol. Soc. of London. Quar. Jour. Geol. Soc., 1879, pp. 1-65. (Reprinted, with a privately published appendix of eighteen plates, containing thirty-six figures (of rock sections) and accompanying descriptions).

The Structure and Origin of Limestones. Rep. Sheffield Lit. and Phil. Soc., 1880, p. 13.

On the Structure and Origin of Non-Calcareous Stratified Rocks. Address delivered at the Anniversary Meeting of the Geol. Soc. of London. Quar. Jour. Geol. Soc., 1880, pp. 1-66.

On the Comparative Structure of Artificial Slags and Eruptive Rocks. Address to the Geological Section of the British Association (Swansea Meeting). Rep. Brit. Assoc., 1880 (issued 1881), 8 pp.

On the Green Colour of the Hair of Sloths. Journ. Lin. Soc., Zoology, XV., 1881, pp. 337-341.

On the Structure and Origin of Non-Calcareous Rocks. Sheffield Lit. and Phil. Soc. Rep., 1881, p. 20.

Five Months' Yachting off the South of England. Sheffield Lit. and Phil. Soc. Rep., 1881, p. 27.

On the Ascidians Collected during the Cruise of the Yacht 'Glimpse,' 1881. Lin. Soc. Journ. ; Zoology, XVI., 1882, pp. 527-536.

On the Colour of the Clouds, Sky, and Sea. Sheffield Lit. and Phil. Soc. Rep., 1883, p. 11.

On the Detection of Sewage Contamination by the Use of the Microscope, and on the Purifying Action of Minute Animals and Plants. Inter. Health Exhib. Conf., July 25th, 1884, 7 pp.

On Forecasts of the Weather as deduced from the Rainfall and Changes in the Barometer. Sheffield Lit. and Phil. Soc. Rep., 1884, p. 15.

Cruise of the 'Glimpse' in 1885. Sheffield Lit. and Phil. Soc. Rep. 1885, p. 13.

The Characteristic Colouring Matters of the Red Groups of Algae. Sheffield Lit. and Phil. Soc. Rep., 1885, p. 19.

On some Remarkable Properties of the Characteristic Constituent of Steel. Proceed. Yorks. Geol. and Polytec. Soc., 1886, IX. (pt. 2), pp. 145-146.

The Recent Earthquake in Essex. Sheffield Lit. and Phil. Soc. Rep., 1886, p. 9.

On the Application of very high Powers to the Study of the Microscopical Structure of Steel. Jour. Iron and Steel Inst., I., 1886, p. 140-144.

On the Microscopical Structure of Iron and Steel. Engineering, LI., p. 73.

The Microscopical Structure of Iron and Steel. Journ. of the Iron and Steel Institute, No. 1, for 1887, pp. 1-34.

Studies in the Border-land of Geology and History. Sheffield Lit. and Phil. Soc. Rept., 1888, p. 62.

Scientific Investigations during the last Fifty Years. Sheffield Lit. and Phil. Soc., 8 pp.

On the Microscopical Structure of Iron and Steel. (Iron and Steel Institute.) 8 pp.

Character of Bricks made at various periods as a means of Estimating the Date of the Erection or Repair of Ancient Buildings. Sheffield Lit. and Phil. Soc. Rep., 1888, p. 22.

On the Temperature of the Tidal Estuaries of the South-East of England. Scot. Geograph. Mag., Nov. 1889. (Presented to the Brit. Assoc. Newcastle Meeting, 1889.)

Archæological Studies in Lincolnshire, Northamptonshire, and Rutlandshire. Sheffield Lit. and Phil. Soc. Rep., 1889 p. 50.

On Oyster-culture in Essex. Sheffield Lit. and Phil. Soc. Rep., 1890, p. 17.

The connection between Early Art in England and the Byzantine, Italian, and Norman styles. Sheffield Lit. and Phil. Soc. Rep., 1890, p. 17.

On English Pictorial Art before the time of William the Conqueror. Sheffield Lit. and Phil. Soc. Rep., 1890, p. 66.

On the Preparation of Marine Animals as Lantern Slides to show the Form and Anatomy. Trans. Liverpool Biolog. Soc., V., 1891, pp. 269-271.

Scientific Studies on Board the Yacht 'Glimpse' in 1889. Sheffield Lit. and Phil. Soc. Rep., 1891, p. 15.

On the Utrecht Psalter, a Pictorial Manuscript of the Eight Century. Sheffield Lit. and Phil. Soc. Rep., 1891, p. 26.

The General Character of Saxon Architecture in the Contemporary Drawings and Existing Buildings. Sheffield Lit. and Phil. Soc. Rep., 1892, p. 14.

On a New Method of Studying the Optical Characters of Minerals. Proceed. West. Yorks. Geol. Soc., VII., pp. 5 et seq.

- On the Natural History of the Estuary of the Thames.** Sheffield Lit. and Phil. Soc., Rep., 1892, p. 18.
- The Roman Wall in Northumberland and the Saxon Churches in the Valley of the Tyne.** Sheffield Lit. and Phil. Soc. Rep., 1893, p. 23.
- Reminiscences and Anecdotes of Scientific Men whom I have Known.** Sheffield Lit. and Phil. Soc. Rep., 1893, p. 15.
- Results of Investigations on the Microscopic Structure of Iron and Steel.** Jour. Iron and Steel Inst., I., 1893, pp. 365-366.
- Natural History Symbolism in Norman Times.** Sheffield Lit. and Phil. Soc. Rep., 1894, p. 13.
- The Mediæval Bestiaries in the Bodleian Library, Oxford.** Sheffield Lit. and Phil. Soc. Rep., 1895, p. 14.
- On the Preparation of Marine Animals and Plants as Transparent Lantern Slides.** In the Sheffield University College 'Commemoration Volume,' pp. 170-188.
- On some Optical Characters of Crystals. (The President's Address.)** Journ. of the Royal Micro. Soc., I. pp. 1-18.
- On Mediæval Geography as illustrated by the Map in Hereford Cathedral.** Sheffield Lit. and Phil. Soc. Rep., 1896, p. 14.
- On the Preparation of Marine Animals and Plants as Transparent Lantern Slides.** Woolhope Nat. Field Club, 1897, 1 p.
- On his Natural History Studies during the last Few Years.** Sheffield Lit. and Phil. Soc. Rep., 1897, p. 29.
- General Remarks upon the Marine Natural History of the Colne Estuary.** Essex Nat., X., 1897, pp. 166-169.
- Notes on the Food of Oysters in Essex.** Essex Nat., X., 1897, p. 166.
- On the Preparation of Marine Animals as Transparent Lantern Slides.** Essex Nat., X., 346-350 and 370.
- Fifty Years of Scientific Research.** Sheffield Lit. and Phil. Soc. Rep., 1898, pp. 13-21.
- Marine Animals Mounted as Transparencies for Museum Purposes.** Museums Assoc. Rep., 1898, 3 p.
- On the General Characters and Colouring of Marine Algæ.** Sheffield Lit. and Phil. Soc. Rep., 1899, p. 15.
- On the Preparation of Marine Worms as Microscopical Objects.** Royal Micro. Soc. Journ., 1900, pp. 1-5.
- On the Structure of the Lower Greensand in the Neighbourhood of Folkestone.** Trans. Union of South-Eastern Sci. Soc., 1900, pp. 19-21.
- On the Geology and Archæology of the Valleys of the Severn and Wye.** Sheffield Lit. and Phil. Soc. Rep., 1900, p. 14.
- On English Church Architecture in Romano-British, Saxon, and Norman times.** Sheffield Lit. and Phil. Soc. Rep., 1900, p. 23.
- On the Variations in Numbers and Habitat of Marine Animals on the Coast of Essex during the last ten or twelve Years.** Essex Nat., XII., 1901, pp. 17-23.
- Note on a Small Shark (*Galeus vulgaris*?) seen in the Brightlingsea Harbour.** Essex Nat., XII., 1901, p. 166.
- On the Preservation of Marine Animals.** Nat., Nov., 1903, pp. 437-440.
- The Marine Zoology of the Coast of Essex.** Victoria Hist. of the Counties of England. Essex Vol. I., 1903, pp. 69-88.
- Notes on Marine Animals obtained in Essex Waters in 1902 and 1903.** Essex Nat., XIII., 1903, pp. 116-117.
- On the Microscopical Structure of Iron and Steel.** The Engineer, LIV., p. 308.
- On the species of Nereis in the district of the Thames Estuary.** Journ. Linn. Soc. (Zoology) 1906.

